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Rainfall estimation using an optical and a microwave link in the Ardèche catchment.

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The Mediterranean basin is considered to be one of the "hotspots" for climate change. One of the main factors in these changes is the availability and distribution of water, both in time and space. To gain more understanding about the hydrological cycle in the Mediterranean basin and to quantify the related processes, the HYdrological cycle in the Mediterranean EXperiment (HyMeX) was set up. This experiment focuses on inter-annual to decadal variability in the coupled Mediterranean system, running during the second decade of the 21st century. During this long experiment, special intensive observation periods are planned, of which the first passed during the autumn of 2012. Within the HyMeX framework, one working group pays special attention to (flash) floods and heavy rainfall. To investigate this, several (small) catchments were heavily instrumented during the first special observation period. We show the first results on rainfall estimation employing an optical link, a microwave link, and a disdrometer in the Ardèche catchment in the south of France for the first special observation period of HyMeX.

Optical and microwave links can be employed to estimate path-averaged rain intensities along a transect of several kilometers, similar in length to the cross-section of a small catchment. The transmitted signal is attenuated by rain along the link path causing a decrease in received power at the end of the link. The attenuation of this signal has a power-law relation to the average rainfall intensity along the link. As a reference, the disdrometer is placed at one end of the link. Link-based rainfall intensities are compared to those based on disdrometer data. However, due to the nature of the observational technique (point measurement vs. average along a link) errors in representation may occur.

The estimation of rainfall intensity from attenuation can be hampered by a number of factors. Principal among these are: moisture on the antennae that is perceived to be rainfall between the antennas (1), signal losses not related to rainfall (2) and errors in the determination of the baseline level, which should be representative of dry weather (3), leading to errors in the attenuation of the received signal and derived rainfall intensity. The influence of these three errors on the rainfall signal will be investigated for this particular set-up.

Complimentary to the rainfall observations, the links can be used during dry periods to measure sensible and latent heat fluxes by applying the scintillation method. This means that both rainfall and evaporation can be observed along the link path, giving good estimates for the atmospheric components of the water balance on the size of a small catchment.